A critical appraisal of *"Neuromuscular electrical stimulation-assisted gait increases muscle strength and volume in children with unilateral spastic cerebral palsy"*

By

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Abstract

Introduction

The purpose of this paper is to introduce the question if electrical stimulation can improve physiological aspects of muscles in CP patients. CP complications were mentioned and reasoning why this critical appraisal was necessary.

Methods

Using Pubmed, keywords, limitations, inclusions, and exclusions were incorporated to find an experimental design. Limitations for the search included CP patients, free full text, clinical trials, and a publication date limit. It was found the authors did this study at a credible institution in Australia. The next step was to determine if their methods and results were correlated in a way that had a good rationale for their study.

Results

The findings found that after 8 and 14 weeks of NMES assisted gait to the treatment group and conventional physical therapy to the control group, there was significant differences. Next, appraisal of the introduction, methods, results, and discussion done by the authors was done. Strengths of this experiment include attention to detail in methods, explanation of tools used for measurements, quantitative details for all variables observed, and a through discussion. Weaknesses include generalization of findings, limitations of the experiment, and not explaining background information enough.

Discussion

The importance of this question and critique is to make sure that NMES assisted gait is a reliable technique that can be used on CP patients. Also, the purpose is to see the other implications that can be added to this intervention to make improvements efficient. NMES is an

easy intervention to do in most clinics and some learning curves may have to happen to perform this experiment. The benefits of NMES outweigh the risks in the clinical setting.

Key words: cerebral palsy, electrical stimulation, muscle strength

Introduction

The importance of this appraisal is to critique the reliability of an experiment that uses NMES assisted gait techniques in CP patients. CP patients tend to have abnormal gait and weak dorsiflexors. Assistance is crucial in preventing further complications and improving the biomechanics in CP patients. Muscle strength and volume aspects need to be assessed for prevention. This leads to the question of whether electrical nerve stimulation of the neuromuscular system enhances the physiological aspects to improve healing and strength with patients who have CP?

Methods

After the clinical question was formulated, the search for what database to use began. Pubmed was the database used for searching. Limitations of the search were free full text, clinical trials, limitation of publication date, and CP patients with NMES. Inclusion of electrical stimulation in CP patients to see how effective this treatment was involved. Exclusion of anything outside of CP and electrical stimulation was not looked at. It was expected to get about 150 hits.

This article came from a credible source and database. The journal of Developmental Medicine and Child Neurology published this study. The experiment was conducted at an approved institution at the clinic of the Cerebral Palsy Mobility Service at Princess Margaret Hospital for Children and The Centre for Cerebral Palsy. Authors of the study are Dayna Pool, Catherine Elliot, Natasha Bear, Cyril J. Donnelly, Caroline Davis, Katherine Stannage, and Jane Valentine. Credentials of the authors were not found. The validity of this article could be diminished due to that factor. Overall, the authors did well on this study. They used reliable equipment and answered their questions that they had. This study was conducted in 2016.

Results

Summary of the study

In this random clinical trial, a study was done on CP patients and NMES assisted gait. The authors wanted to test how effective neuromuscular electrical stimulation (NMES) assisted gait works on dorsiflexor muscles in an 8 and 14-week time frame compared to a control group (conventional therapy). The treated group had much more improvement by week 8 compared to the control group. There was no difference in strength after the patients were observed at the 14th week. It was concluded that NMES is effective for the first eight weeks in strengthening muscles. An integration of conventional and NMES can be an effective way of treatment for short term and long-term improvements.

Appraisal of the study introduction

The article goes into detail about neuromuscular electrical stimulation and describes pioneering studies on this topic. It mentions CP patients in a brief paragraph at first which is an important aspect of this study. The expected conclusion of this study is CP patients with NMES will improve muscle strength and volume more compared to the control group at the 8-week and 14-week assessments. The author used good literature to form a sound rationale for the study. He studied short term and longer-term assessment on the patients and added in a control group which most pioneering studies did not incorporate. Most of the authors sources are credible, are well conducted experiments, and are not too out of date. They reference the tools used in the study well too. The objective of the study was understood from the introduction.

More background information on CP patients and what abnormalities they develop in the gait cycle would have been more sufficient. The authors did not explain what a community-applied NMES-assisted gait program means. More explanation on this in the introduction could

be included to give a better understanding. Only one of the sources used by the authors is out of date and more recent research should be incorporated to make their findings more valid.

Appraisal of the study methods

The research design is a randomized control trial with an experimental group and control group. It is a prospective experimental research design, cross sectional study, and double blinded study. Each test was conducted by a physiotherapist and their assistant meaning this was a within-subjects design. The investigators managed all the groups fairly by adding in criteria to be a part of the study. They normalized the data for muscle strength in everyone then used different tests also for other normalizations.

Authors do not state whether withdrawal or loss to follow-up occurred over this study. The authors did not specifically describe well what kind of physical therapy techniques were used on the control group. Limitations could be the funding and limitation of range of motion using the walk aide in the experiment causing misconstrued results. This experiment could be replicated, but physical therapy treatment for the control group could vary from what they did in this experiment. There were many statistical analyses used in this article. The analyses were briefly described of their purpose.

Appraisal of the study results

The results section is written clearly. Authors asked about muscle volume, then muscle strength, and lastly selective motor control. Each concept was answered in thorough detail. The results do address the research question. They determined that muscle volume, strength, and selective motor control was use-dependent and not good for long-term treatment. The authors had two hypotheses of which one was supported and the other was not. They made scattered plots about the differences between the two groups at each assessment period. The statistically

significant results are those with a p-value less the .05. This includes muscle volume of the gastrocnemius and tibialis anterior (not soleus) for the treatment group, muscle strength of the same muscles for the treatment group, and selective motor control.

One problem seen with table 3 is throughout the paper the authors talked about measurements on the soleus, but it is not presented in the table. Also, the authors did not mention anything about minimal clinically important differences in the results.

Appraisal of the study discussion

The authors did good of discussing how this experiment is clinically important. The authors mention other primary literatures about NMES and spinal cord injuries. The authors address clinical significance of the study by stating that NMES can be beneficial for CP patients early on in treatment and consider it to be use-dependent. The authors state that NMES is good for increasing muscular volume and strength.

The weakness of the literature about spinal cord injury and NMES is that a spinal cord injury is different from CP. This could be a generalization of the findings from that study to the current experiment being appraised. The limitations are that participants actively sought to participate in the study which accounts for the high compliance, funding, the accessor was not blinded, bias, and limitation on range of frequency parameters on the walk aide. The authors used a small population for this study and the results could be generalized for a bigger population.

Discussion

The importance of this study is to find techniques that improve the functionality of movement in CP patients. This concept is important in clinical cases because it is dealt with commonly. CP patients have trouble walking and having a normal gait cycle. NMES strengthens

their muscles so they can improve their biomechanics more easily. A tendency of fall risk is associated with CP. NMES is a way of quickly improving functional mobility and effectively enhances muscle hypertrophy early in intervention. The ability of improving strength and biomechanics in CP patients can prevent further abnormalities. The relevance of this study to the clinical question is that NMES is effective for early intervention. At the14-week period there is little difference between conventional therapy and NMES applied to the lower extremity muscles.

This intervention can be a useful instrument utilized in the clinical setting for CP patients. The authors thoroughly thought through how to make their experiment fair for every patient. They normalized their data and used reliable instruments to make their measurements. The benefits of using NMES assisted gait in the clinic include quicker muscle volume and strength in the early stages of treatment, more specifically in the first 8 weeks. With incorporating a control group, it helped give information that conventional physical therapy can also be incorporated with NMES assisted gait. It was proposed that switching the interventions every 8 weeks could be the most beneficial for the patient. The risks of the intervention include irritation by the patient and cardiac problems with patients who have preexisting heart risks. The benefits outweigh the potential risks because irritation can be solved by less stimulation and people with heart problems will have to avoid using this intervention which would be identified in their assessment. To improve the argument of using this intervention the authors could have done more of a longitudinal study over multiple 8-week periods and switching out NMES and conventional physical therapy each period. Including other studies of using NMES assisted gait could also improve their argument for using this intervention not only on CP patients, but others as well with strength deficits.

This study can be used as evidence because many clinically significant results came out of this experiment. An intervention that can be efficient in treatment should be utilized. Increasing the time it takes to improve strength and volume in a patient is very beneficial in any clinical setting. Many reliable instruments were used to conduct this study along with thorough methodology. Implementing this intervention in the clinic would be easy to do. Most clinics have easy access to electrical stimulation. It is a simple procedure to set up. The right amount of stimulation needs to be acquired knowledge of as well as where to apply it.

Overall, the authors did a great job in presenting and doing their experiment. A well thought out experiment was done with a detailed introduction, methods, results, and discussion. More background information could be incorporated by the authors with a bigger population also for reliability purposes. This experiment could be replicated in most clinical settings and give beneficial effects to CP patients.